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HIGH QUALITY EGGS

for — Illinois Markets



Circular 494

University of Illinois · College of Agriculture, Agricultural Experiment
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CONTENTS

	PAGE
CHIEF CAUSES OF SMALL AND LIGHT EGGS.....	3
Hens May Have Inherited Small Egg Size.....	3
Underdeveloped Pullets Lay Small Eggs.....	3
Extreme Temperatures Affect Weight.....	4
Deficient Rations May Lower Size and Weight.....	5
THIN SHELLS USUALLY DUE TO FAULTY RATIONS.....	6
EGG WHITE PROBLEMS.....	7
Hot Dry Weather Often Causes Watery White.....	7
Range May Be Indirect Cause of Thin White.....	8
Rough Handling Lowers Quality of Egg White.....	9
EGG YOLK PROBLEMS.....	11
Off-Colored Yolks Caused by Feed.....	11
Flattened Yolks Result From Age and Faulty Storage.....	11
MISCELLANEOUS PROBLEMS.....	12
Off-Flavored Eggs.....	12
Meat or Blood Spots.....	12
Blood Clots and Bloody Eggs.....	13
Blood Rings and Fertile Eggs.....	13
Tremulous Air Cells.....	13
How to Prevent Dirty Eggs.....	14
Freak Eggs.....	15
MEASUREMENT OF EGG QUALITY.....	18
Depth of Air Cell.....	18
Visibility and Movement of Yolk.....	18
Shell Defects.....	18
CANDLING TECHNIC.....	19
FARM STORAGE ROOMS AND COOLERS.....	21
Egg Storage Rooms.....	21
Homemade Egg Coolers.....	22
EGG SCALES.....	24
PACKING EGGS FOR MARKET.....	25
Packing Procedure.....	25
Mixed Packs.....	26
PRESERVING MARKET QUALITY.....	28
THE PROCESS OF EGG FORMATION.....	29

High-Quality Eggs for Illinois Markets

By H. H. ALP, Assistant Professor of Poultry Extension

BETTER EGGS can often be produced and marketed with little or no additional money outlay—more care at certain vital points may be all that is needed. What the principal problems are in high-quality egg production and how they can be met is the subject of this circular. While complete answers to some of the problems are still to be determined, if producers will utilize what information is already at hand they will be able to make vast improvement in the quality of the eggs they are placing on the market, and they should be able to benefit accordingly.

CHIEF CAUSES OF SMALL AND LIGHT EGGS

To make an attractive pack, eggs should be uniform in size, shape, and color of shell. Since these three characteristics are largely inherited, a producer must look to breeding and selection for the greatest improvement. This means that eggs that are to be used for hatching must be carefully selected, especially for size and weight.

Some of the chief causes for small or light-weight eggs are the inheritance of small egg size, poor physical development of pullets, extremes in weather temperatures, and deficient rations.

Hens May Have Inherited Small Egg Size

It is not necessarily true that large hens always lay large eggs. Egg size is just as much the result of breeding as is feather color, type of comb, or shape of body. A flock owner should therefore not be misled by the size of a mature hen, but should note carefully the size and weight of her eggs and select very few of them for incubation if they weigh less than 2 ounces, which is considered the standard weight.

Underdeveloped Pullets Lay Small Eggs

Eggs cannot be of maximum size until hens have reached their mature body weight, which usually requires about 40 weeks. Even then the eggs may be too small to be of much market value. More pullet and

"peewee" eggs than normally expected are often the result of the pullets' lack of physical development before starting to lay. In experimental work done at the University of Missouri¹ it was found that

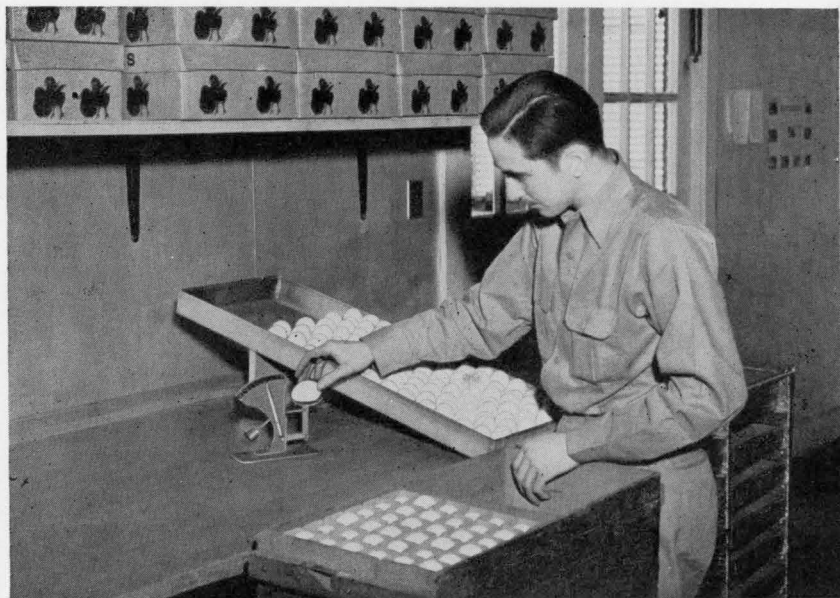


Fig. 1.—Size, shape, and shell color are important when selecting eggs for the incubator

All three of these characteristics, which are so important on the market, are inherited, and therefore should be given consideration when eggs are being selected for hatching. In general, the kind of eggs from which hens hatch are the kind of eggs they will lay.

birds which began laying at an early age laid smaller eggs than did pullets which were older when they produced their first eggs.

In feeding and raising pullets, the practical poultryman should pay more attention to good physical development than to early sexual maturity.

Extreme Temperatures Affect Weight

The decline of egg weight during extremely hot and extremely cold weather is not uncommon. In test shipments from Illinois to New York in the summer of 1936, the weight of the eggs decreased notice-

¹Missouri Agr. Exp. Sta. Bul. 332.

ably as the weather temperatures increased (Fig. 2). The exact reason for such a decrease is still largely a matter of conjecture. However, it is reasonable to suppose that it would be less noticeable in flocks given some protection from extreme heat. This might include shaded windows, plenty of clean water and feed conveniently located,

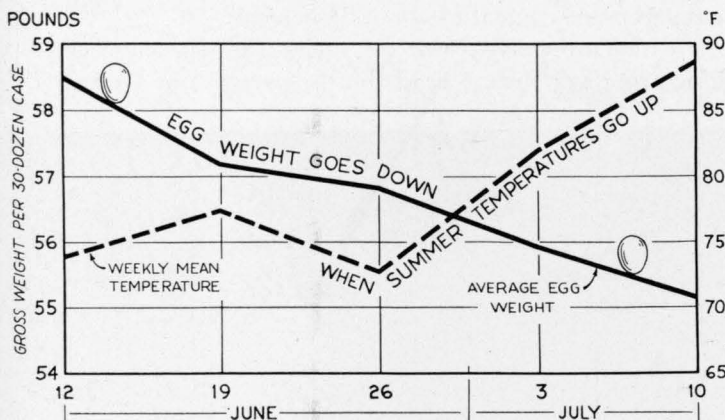


Fig. 2.—Egg weight falls off in hot weather

In a test during five summer weeks, all the eggs marketed from 1,200 layers (hens and pullets) were weighed and weekly averages computed. When the temperatures advanced from about 73° F. to 88° the eggs lost an average of $3\frac{1}{2}$ pounds per case.

shade if outdoor range is being provided, insulated houses, cross ventilation of houses, and, during excessive heat spells, removal of floor litter and sprinkling of the floor with cold water.

Deficient Rations May Lower Size and Weight

Altho egg weight is determined primarily by inheritance, it may be lowered by deficiencies in the ration. For this reason complete rations should be fed (See Illinois Circ. 275, "Feeding for Egg Production").

There is some evidence that birds fed milk as part of their ration will lay larger eggs than those not getting it.

THIN SHELLS USUALLY DUE TO FAULTY RATIONS

Deficient rations are probably the main cause of thin-shelled eggs. Since the egg shell consists almost entirely of calcium carbonate, plenty of calcium is needed in the feed. A simple way to supply it, is to keep always available to the flock high-grade oyster shell with a calcium carbonate content of about 95 percent.

The extent to which a bird can make use of calcium carbonate in manufacturing egg shell depends on the presence of vitamin D in the

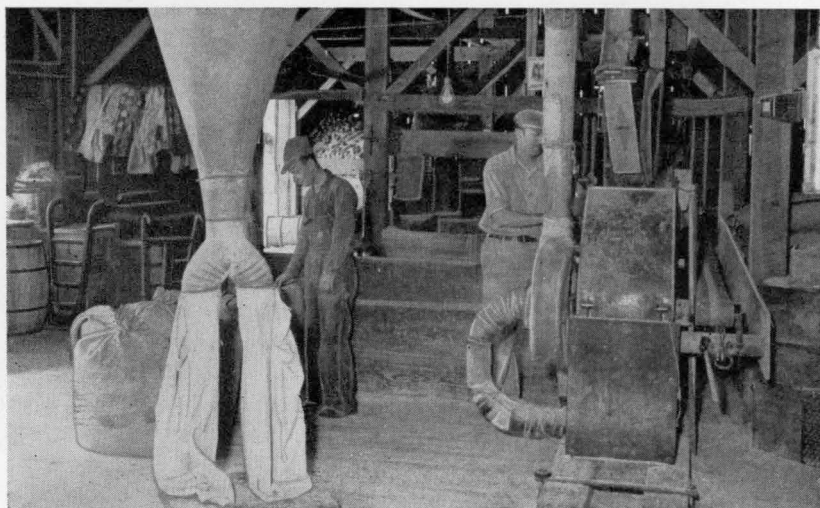


Fig. 3.—Local elevators can simplify the problem of mixing vitamin D supplement in poultry rations

All vitamin D supplements should be thoroly mixed thru the ration. The inclusion of some carrier of vitamin D, such as cod-liver or sardine oil, helps to maintain normal egg-shell texture and adds somewhat to the nutritive value of eggs.

ration or the exposure of the flock to liberal amounts of direct sunlight. It is the absence of these two factors—sunlight and vitamin D—which often explains why soft-shelled eggs are more common in winter.

The inclusion of a vitamin-D concentrate, such as cod-liver oil or sardine oil helps to improve egg-shell texture when flocks are confined to laying houses. These oils are usually fed at the rate of 1 percent of the mash part of the ration, altho smaller amounts of fortified oils are sometimes used.

EGG WHITE PROBLEMS

Consumers look at the egg white as one means of determining the quality of individual eggs. The measurement generally used is the amount of thick, jelly-like white around the yolk. Flock owners should therefore take every precaution to produce and market eggs with this characteristic.

Hot Dry Weather Often Causes Watery White

Eggs with a runny white are one of the chief problems with which the producer of quality eggs has to contend. While the exact cause of this condition in every instance is still to be determined, hot dry weather is known to be a contributing cause.

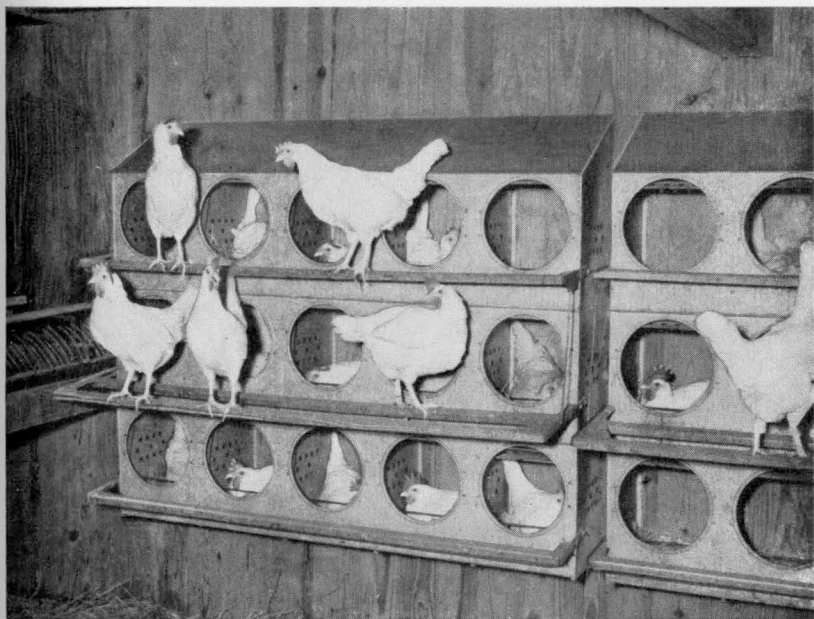


Fig. 4.—These are good nests but they are not a good place to leave eggs

From 20 to 30 nests should be provided for a hundred hens, and the eggs should be gathered at least three times a day in hot weather—twice in the forenoon.

During this kind of weather eggs should be picked up from the nests at least three times a day. Not only will the laying house be quite hot, but the normal body temperature of the hens will be about 107° F., and when eggs are left in the nests during the day, the heat

will cause the white to become thin and watery. Particularly is this true when broody hens are allowed to stay on the nests.

After they are gathered, eggs should be allowed to cool before being placed in cases or cartons. If gathered in pails or tight baskets they should be spread out to permit quick cooling. Wire baskets are often used for collecting eggs because they let the heat escape.

In hot weather eggs should be marketed at least twice a week; and they should be carefully protected from heat and sun while in transit.

Range May Be Indirect Cause of Thin White

While there is no definite evidence to prove that the quality of the egg white is lowered when hens are permitted an unlimited range, the best eggs appear to be coming mainly from flocks that are either con-



Fig. 5.—On unlimited range quality production is impossible

Flocks that range over the farm, picking up all kinds of feed, will not produce eggs of uniformly high market quality. A limited, controlled range is necessary both for volume of production and for quality of eggs.

finer to houses or are permitted only very limited range. In test shipments from Illinois to New York in 1936, eggs from flocks allowed free run of the barnyard graded decidedly lower than those from flocks confined or on limited range with access only to the rations provided and no chance for scavenger feeding.¹

For the owner of a small flock the solution of the range problem

¹Studies of the Market Quality of Eggs From 109 Farms in Southeastern Illinois. Ill. Agr. Exp. Sta. Bul. 441.

seems to be to keep the flock confined for about two-thirds of the day. Limiting the range this much will help not only to improve the quality of the eggs, but also to produce clean eggs and maintain production at a steady level.

Rough Handling Lowers Quality of Egg White

The normal white of a fresh egg is made up of three rings of albumen, two of them thin and the other quite jelly-like. They will

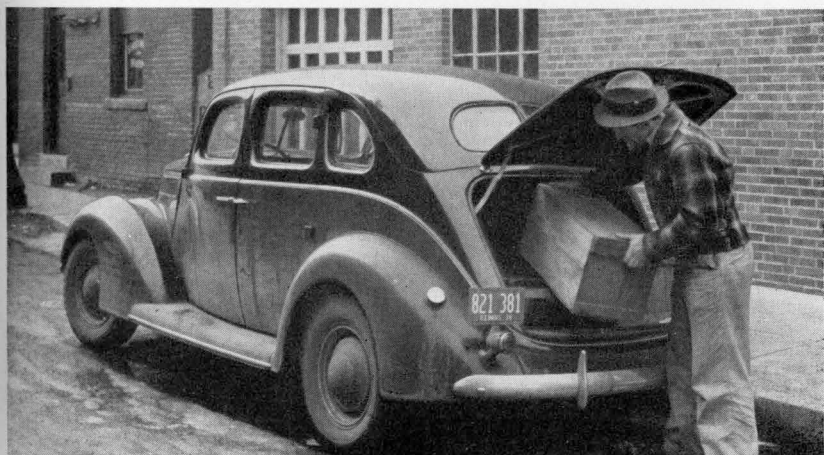


Fig. 6.—Market eggs should be transported with the least possible jolting

In the back of the car or the trunk compartment is the right place for quality eggs. Don't risk them on the running board.

be found in the broken-out egg as a thin ring of white next the yolk, a thick jelly-like section next to the thin ring, and then another layer of thin white. In a new-laid egg the total egg white weighs about 34 grams. The outer liquid makes up about 22 percent of this weight, the inner liquid about 25 percent, and the middle layer of thick or firm white about 53 percent. Thus the total volume of thin white is about equal to the volume of thick white.

Rough handling or jarring seems to have a tendency to break down the partitions between the three layers of egg white, causing the thick white to become diluted with thin white. Care should therefore be taken to avoid setting a basket or pail of eggs down roughly or bumping it against the door jamb when gathering eggs, or handling the cases carelessly when loading them into the wagon or truck.

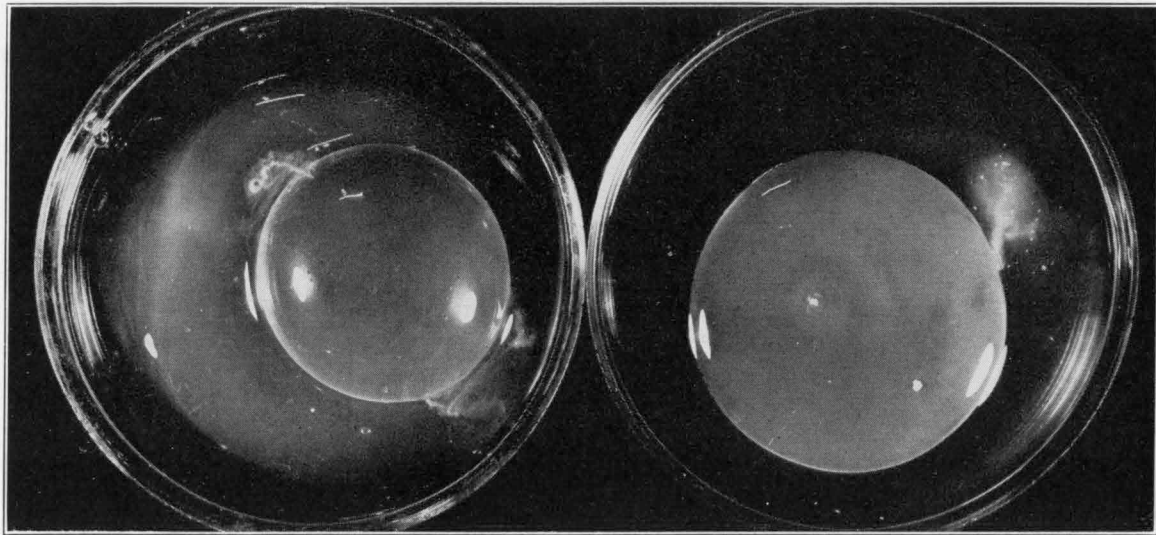


Fig. 7.—Quality in eggs is easy to recognize

The yolk of a good market egg (*left*) is firm and well rounded and stands up well. The white is thick and jelly-like. In an egg of poor quality (*right*) the yolk is usually quite flat and soft, and the white is thin and watery, as in the egg at right, which had been incubated for three days. Thin, weak whites sometimes occur in freshly laid eggs and may be the result of poor care or of inheritance.

EGG YOLK PROBLEMS

Color and shape are the two most common measures of yolk quality. Uniformity of yolk color is to be desired rather than any particular shade of color. Consumers favor eggs with yolks which are alike in color and well-rounded in shape.

Off-Colored Yolks Caused by Feed

Variation in yolk color is due to the inclusion of differently pigmented feeds in the ration or to materials eaten by the flock while on free range. Because it is impossible to control the feed of birds on free range, a laying flock should be kept on limited or confined range. When this is done, there should be greater uniformity of yolk color than when birds have the run of the farm.

The extremely dark yolks occasionally found in eggs are, in Illinois, caused mainly by the hens eating large quantities of certain types of green feed, such as rank-growing rape, kale, or weeds. Two weeds often thought to darken yolks are penny cress and shepherd's purse.

Yellow corn and alfalfa are sometimes said to cause dark-colored yolks, and it is true that the yolks will be darker from hens given these feeds than from hens not so fed, but the yolk color resulting from their use is not in any way objectionable to consumers. So important are these two feeds in supplying vitamins needed to maintain the health of the flock, that they should always be included in the ration.

Flattened Yolks Result From Age and Faulty Storage

Fresh eggs have upstanding, well-rounded yolks (Fig. 7). The breakdown, or flattening, of the yolk is apparently caused by slow penetration of water from the egg white. This dilution is undoubtedly retarded by proper storage conditions, and it is for this reason that a producer who wants to market quality eggs should provide a cool and fairly humid room in which to hold them.

MISCELLANEOUS PROBLEMS

Off-Flavored Eggs

Occasionally one hears complaints that certain eggs are off-flavor. Badly flavored eggs, however, are not common if good production practices are followed. They may be traced to certain feeds eaten by the flock, or to faulty storage conditions. Onions, rape, turnips, and fresh fat fish, if fed in excess, impart objectionable flavors to eggs. Eggs will also take on undesirable flavors if stored in rooms having strong odors, or if stored in the same room with citrus fruits.

Meat or Blood Spots

Small foreign particles may find their way into the oviduct during the formation of the egg and become part of it. Such particles later appear as bits of tissue-like material floating around in the egg white and are called meat or blood spots. A producer who sells direct to



Fig. 8.—Surplus roosters should be marketed after the breeding season

Breeding males, if not to be sold, should be penned separately from the production flock after the close of the breeding season. Fertile eggs will not reach consumers in good condition in summer. At temperatures above 65° F. incubation takes place.

consumers should candle to eliminate all such eggs. There is no need to candle eggs when selling them to regular egg buyers.

Blood Clots and Bloody Eggs

The rupture of a small blood vessel during the formation of an egg will cause blood clots and bloody eggs. Such eggs are considered unfit for food, and, as with the meat spots, producers should candle these eggs out when selling direct to consumers.

Blood Rings and Fertile Eggs

Blood rings occur only in fertile eggs and are the result of partial incubation, the great scourge of the fresh-egg market during hot weather. *There is just one way to prevent them, and that is to produce only infertile eggs.* Illinois farmers lose thousands of dollars annually by marketing fertile eggs.

It is almost impossible to market eggs of high quality unless they are infertile. This is particularly true during hot weather, since a fertile egg will start to incubate at a temperature slightly above 65° F. It is for this reason that fertile eggs have little chance ever to reach the consumer in good condition. A very high percentage of them will be thrown away as rots—one of the biggest losses a producer suffers.

The only way to prevent fertile eggs is to remove all males from the laying flock immediately after the close of the breeding season (Fig. 8).

Tremulous Air Cells

Very soon after an egg is laid, an air cell or air pocket can be found at or near the large end. This air cell is normally stationary, but in every shipment of eggs there will be some with tremulous (movable) air cells. Buyers are inclined to discount a pack of eggs showing any appreciable number of tremulous air cells. It is reasonable to suppose that rough handling or the jarring of the eggs will help to cause this condition.

That large eggs hold up better than small eggs in transit is indicated in the following table.¹

<i>Weight of 30-dozen case</i>	<i>Percent eggs with tremulous air cells</i>	<i>Total dozens</i>
Less than 55 pounds.....	26.9	1,530
55 to 58 pounds.....	19.9	10,380
More than 58 pounds.....	17.0	3,840

¹See Illinois Agr. Exp. Sta. Bul. 441, p. 405.

A possible explanation for the high percentage of light-weight eggs with tremulous air cells is that the smaller eggs, not fitting tightly in the standard-size filler, rattle around more than the larger ones.

How to Prevent Dirty Eggs

Dirty eggs should not be a bothersome problem to any producer, for eggs will not usually get dirty if simple precautions are taken. For the production of clean eggs ample nests are necessary (one to every five hens), a clean house, and a wired droppings board (Fig. 9). Then the birds must be kept confined to the house until laying has

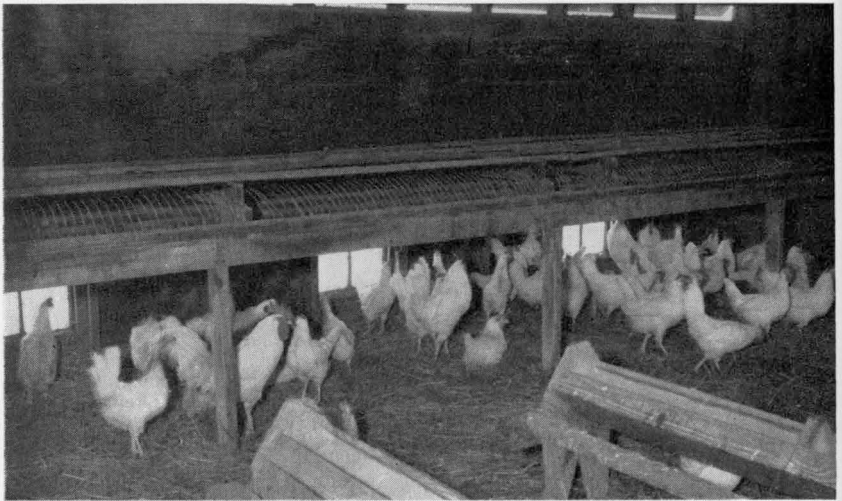


Fig. 9.—A clean house means cleaner eggs

A screened droppings board and a clean house are a great help in reducing the number of dirty eggs. Slightly dirty eggs can be cleaned fairly successfully, but it is far better to take simple precautions to prevent eggs from getting soiled.

been completed for the day; all broody hens must be kept off the nests; the nests must be closed at night to prevent roosting in them; and clean litter must be kept in the nests.

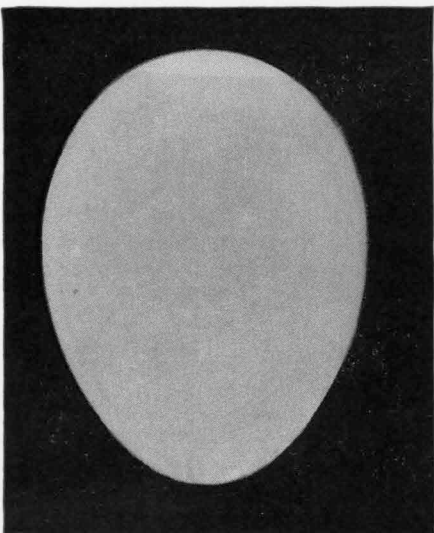
If some eggs do get dirty and must be cleaned, it is poor practice to wash them, for washed eggs are easily detected by an experienced buyer and they deteriorate much more readily than unwashed eggs.

Cloths dampened with a mixture of vinegar and water, or egg cleaning brushes can be used to remove dirt spots. Solutions of sodium hydroxid have recently been found effective for cleaning dirty eggs.¹

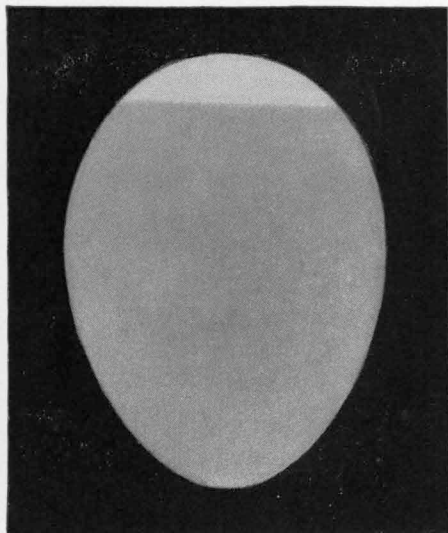
Freak Eggs

Freak eggs are not a problem, nor are they of any particular value. At the back of this circular is a description of the way in which eggs are formed. Whenever there is any abnormal functioning of the oviduct, some abnormality in the egg such as double yolk or odd shape is apt to result.

¹Missouri Agr. Exp. Sta. Res. Bul. 277, 1938.



U. S. SPECIAL



U. S. EXTRA

Shell: clean, sound, normal.

Shell: clean, sound, normal.

Air cell: $\frac{1}{8}$ inch or less in depth, regular.

Air cell: $\frac{2}{8}$ inch or less in depth, regular.*

Yolk: well centered, outline indistinct, motion sluggish, free from visible germ development and other defects or blemishes.

Yolk: fairly well centered, outline moderately defined, may be slightly mobile, free from visible germ development, and practically free from other defects or blemishes.

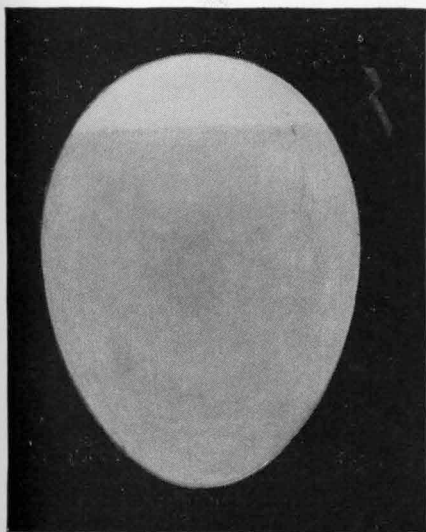
White: firm, clear.

White: firm, clear.

*(Eggs that otherwise fully meet the specifications of U. S. Extra but have slightly tremulous air cell (a movement not in excess of $\frac{1}{8}$ inch) may be classed as U. S. Extras in the retail grade of U. S. Extras.)

The above specifications are the official U. S. Department of Agriculture standards as of June, 1935.

QUALITY FOR INDIVIDUAL EGGS



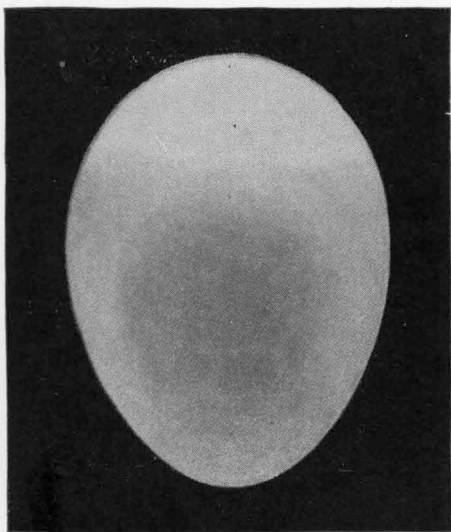
U. S. STANDARD

Shell: clean, sound, may be slightly abnormal.

Air cell: $\frac{3}{8}$ inch or less in depth, may show movement not in excess of $\frac{1}{2}$ inch.

Yolk: outline well defined, may be mobile, may show slightly visible germ development, and other definite but not serious defects.

White: reasonably firm, clear.



U. S. TRADE

Shell: clean, sound, may be abnormal.

Air cell: may be over $\frac{3}{8}$ inch in depth, may show movement in excess of $\frac{1}{2}$ inch, may be bubbly, or free.

Yolk: may be plainly visible, may be freely mobile and cast dark shadow, and show clearly visible germ development but no blood, may show other serious defects.

White: may be weak and watery.

If eggs are bought on a graded basis in your community, they may not be sorted according to these standards but the same quality factors will be considered.

MEASUREMENT OF EGG QUALITY

When eggs are sold by grade, the measurement of quality made by the person candling usually consists of a check-up on the depth of the air cell, the visibility and movement of the yolk, and the shell defects.

Depth of Air Cell

The air cell is usually found at the large end of the egg. In the new-laid egg the air cell will be quite small, usually $\frac{1}{8}$ inch deep or less. The greater this depth, particularly if it exceeds $\frac{1}{4}$ of an inch, the greater will be the suspicion of the grader that the egg is not good enough for the top grade. Improperly stored eggs will soon show a large air cell as the result of evaporation of moisture thru the pores of the shell.

Visibility and Movement of Yolk

The visibility of the yolk, as noticed by the candler when he twirls the egg before the candling lamp, is another important measurement of quality. A very indistinct yolk shadow or outline and a slow-moving yolk indicate high quality. If the yolk is clearly visible and moves very quickly when the egg is rotated, the white is probably thin and watery, permitting the yolk to float easily near the shell. Experience has shown that in such eggs the yolk will not be well centered, but will be nearer the bottom of the egg; and that when these eggs are broken, the yolk will be flattened.

Degree of yolk color cannot be accurately determined by the present method of candling.

Shell Defects

The candler will also watch for shell defects, such as small cracks, spoken of as "checks." Sound shells can usually be demonstrated by clicking the eggs together in the hand while candling them, and listening for the characteristic ring.

CANDLING TECHNIC

In the main it is not necessary for producers to candle their eggs; in fact the less handling the eggs get the better will be their quality. The inclusion of this section on candling technic is not, therefore, intended to imply that all producers should learn to candle, but only to supply instructions for those who may need them.

To be a good candler one must learn to judge from the appearance of an egg before a candling lamp what it will look like when broken



Fig. 10.—Candling is necessary when developing a special retail market

For wholesale market eggs, however, candling is not usually necessary or desirable on Illinois farms. A poultryman who follows good production practices and the usual recommendations for the care of market eggs will have a product of uniform quality, and the fewer times his eggs are handled, the better.

out of the shell. With experience, a fairly accurate measurement of egg quality can be made in this way.

The candling lamp should be placed about waist high, usually in a darkened room, for most candling equipment has been designed for use in this way.

The actual candling is done by placing the large end, or air cell end, of the egg at the opening on the candling lamp (Fig. 10). The egg should be held slightly at an angle and given about half a twirl right and left before the light. This twirling or rotating of the egg is for the purpose of observing the movement and visibility of the yolk, the depth and motion of the air cell, and the presence of meat spots or blood spots.

Experience is necessary to become familiar with the difference in the way brown and white eggs look before the light, the differences in shell composition, and the likelihood of confusing the chalazae with meat spots.



Fig. 11.—An outdoor bank cellar is an excellent place to hold market eggs for a few days

Since eggs readily absorb off-flavors, the cellar should be free from all strong odors.

FARM STORAGE ROOMS AND COOLERS

Egg Storage Rooms

So important is the care of eggs immediately after they are laid that the room in which they are kept prior to selling becomes probably the greatest single factor in conserving egg quality. This room should be comparatively cool and the air fairly humid. The temperature should be about 50° to 60° F., altho slightly higher temperatures will not damage eggs that are held only for a short time, especially if the room humidity is fairly high. If extra moisture is needed during certain times of year, it can be supplied by sprinkling the floor and walls with water, or by hanging clean, wet burlap sacks on the walls. Good ventilation should be provided in rooms with high humidity in order to prevent the growth of molds.

On the farm two possibilities for egg storage rooms are the outdoor bank-type cellar (Fig. 11) and the basement cellar (Fig. 12). While

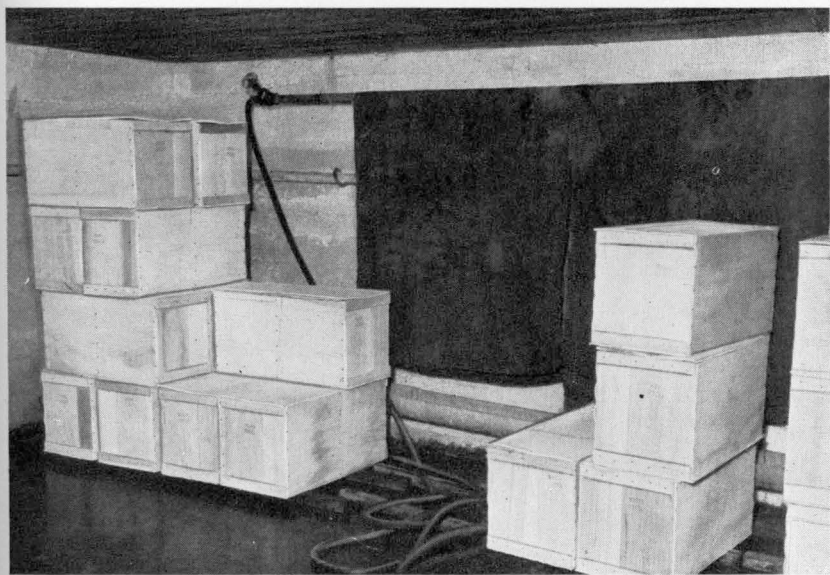


Fig. 12.—Basement cellar can provide good temporary storage for eggs

Moderately low temperature and fairly high humidity are essential in temporary storage rooms. Evaporation of water from the egg white will then be largely prevented and the air cell will be kept small. The wet burlap hanging on the wall supplies additional humidity. When eggs are stored in a basement, the cases should be placed on wooden strips to lift them off the floor.

such rooms need not be limited to egg storage, it should be remembered that eggs will take on odors, and for this reason materials with strong odors should not be stored in an egg room. Of course, all the materials used in packing eggs for market—egg cases, fillers, flats, and cartons—should be stored in the egg room.

Homemade Egg Coolers

When a cellar is not available for egg storage, homemade egg coolers can be used with fairly satisfactory results. The value of such coolers was demonstrated in test shipments of Illinois eggs to New York in the summer of 1936. Two shippers who had not been using coolers started to use them and found a much larger percentage of their eggs reaching the New York market as extras (see table).

QUALITY OF EGGS BEFORE AND AFTER USING COOLERS, AS INDICATED BY U. S. GRADINGS AT NEW YORK ON SHIPMENTS BY TWO FARMERS IN 1936 TESTS^a

	Before using cooler: percent grading—		After using cooler: percent grading—	
	Extra	Standard	Extra	Standard
<i>Shipper A</i>				
June 19.....	75	25	...	...
June 26.....	60	40	...	...
July 3.....	...	...	90	10
July 10.....	...	...	80	20
<i>Shipper B</i>				
June 19.....	65	35	...	...
June 26.....	40	60	...	...
July 3.....	30	70	...	...
July 10.....	...	...	75	25

^aFrom Illinois Agr. Exp. Sta. Bul. 441.

These coolers are usually made to hold from two to four cases of eggs, and are equipped with two trays for cooling freshly gathered eggs. Construction is quite simple (Fig. 13). The sides of a two-by-four frame are covered with burlap hung from a water pan on top of the cooler. Acting like lamp wick, the burlap soon becomes wet. The room air, passing thru the wet burlap, is cooled. Thus the temperature on the inside of the cooler is lowered and at the same time the air is kept moist.

Trouble from mold may develop if the cooler is used in a room without sufficient ventilation.

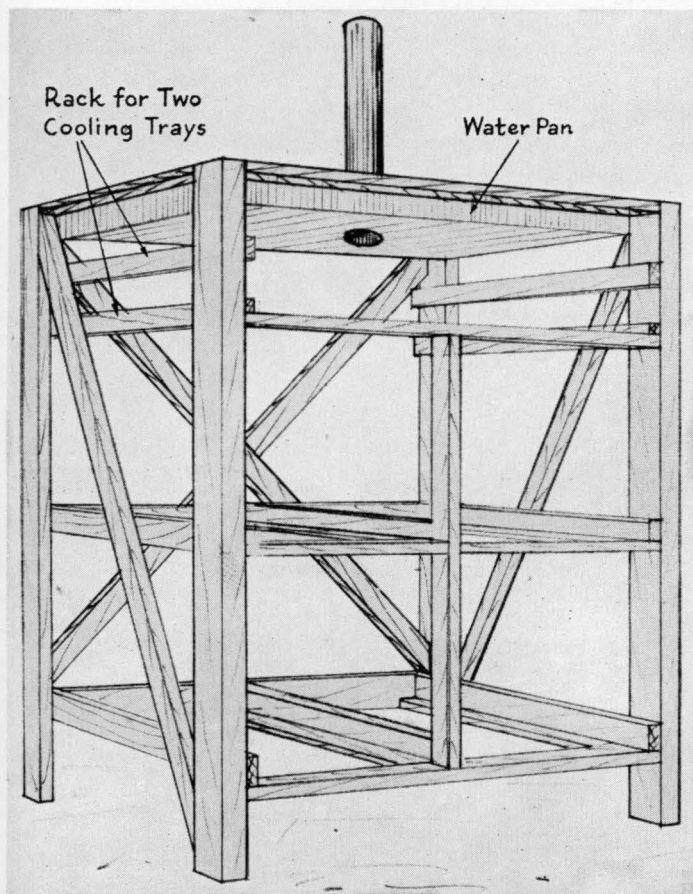


Fig. 13.—Homemade egg coolers help some shippers to market more top grade eggs

This cooler is 4 feet high, 3 feet wide, and 2 feet 8 inches deep, outside measurements, and will accommodate four egg cases. These dimensions can be varied according to the number of egg cases it is desired for the cooler to carry. Before constructing a large cooler, the width of doors thru which it may be necessary to take it should be checked.

EGG SCALES

Producers who desire to market quality eggs should equip their egg room with a good scale, and should get into the habit of weighing their eggs. For fancy packs it is often necessary to indicate weight grades, and the labor required to do it is usually well paid for. Weight grades commonly used are the following:

<i>Weight grade</i>	<i>Weight of one dozen eggs</i>	<i>Gross weight per 30-dozen case</i>	<i>Net weight per 30-dozen case</i>
Large.....	24 to 26½ oz.	58-61 lb.	46-49 lb.
Medium.....	20½ to 23½ oz.	53-57 lb.	41-45 lb.
Pullet.....	18 to 20 oz.	48-52 lb.	36-40 lb.
"Peewee".....	16 to 17½ oz.	44-47 lb.	32-35 lb.

There are various types of practical and inexpensive egg scales on the market. They range from the simple individual egg scales (Fig. 14) to the large, mechanically operated machine capable of grading a large number of eggs by weight in a short time. Premium prices are usually paid on large eggs if graded for size.

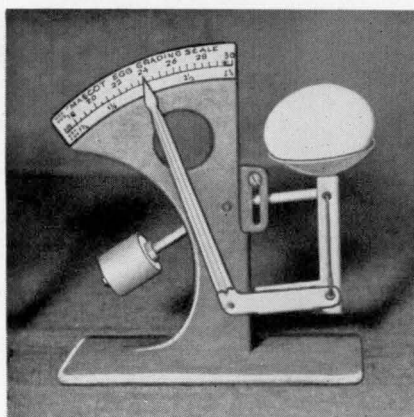


Fig. 14.—Egg scales should be standard equipment for producers marketing quality eggs

Some markets require that the weight grade be indicated on fancy packs. With scales as a guide, one can learn to judge egg weight fairly accurately.

PACKING EGGS FOR MARKET

A neat, properly packed case of eggs is always a good introduction to a buyer. The 30-dozen wooden egg case is at present most commonly used. It is divided into two sections capable of holding five layers each, with 3 dozen eggs to the layer. The packing materials within the case are spoken of as fillers and flats. The fillers provide the packing around each egg and the flats serve as pads between the layers.

Packing Procedure

In packing a 30-dozen case of eggs the usual practice is to proceed about as follows:

Place one excelsior pad (or two cup flats, back to back) on the bottom of each compartment of the case. Follow with a filler. Then place the eggs in the filler *small ends down*. Packing the egg with the

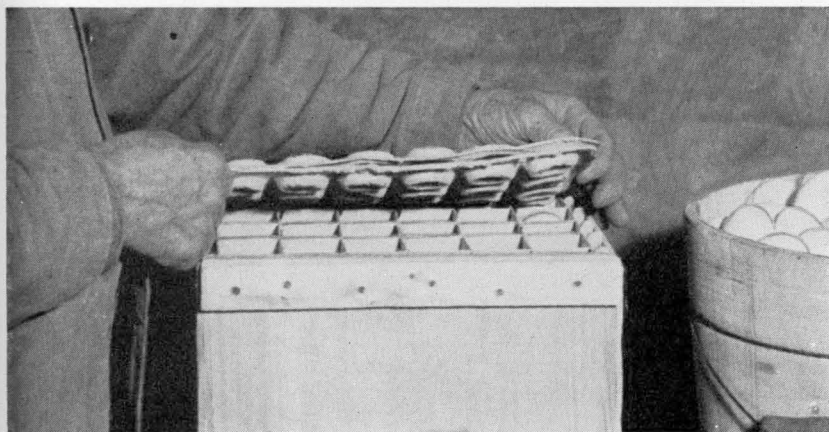


Fig. 15.—Special protection is needed at top and bottom of case

Two flats placed back to back are commonly used for finishing off a 30-dozen case. By cushioning the top and bottom layers, they help prevent damage at these points, where most of the damage occurs.

small end down helps to keep the yolk well centered; this is important. Then place flat on top of each layer of eggs. In finishing off the case, cover the top in the same manner as the bottom, that is, with an excelsior pad, or two flats back to back (Fig. 15).

To nail on the lid, four nails for each end are plenty. Never put

nails in the center of the lid, for they will destroy any cushion effect the lid might have when cases are piled on top of one another. Label the case on both ends, not on the top.

New cases, fillers, and flats are recommended (Fig. 16). They will make a neater looking pack and there will be less danger from breakage and stale odors from used materials.



Fig. 16.—Only new packing materials are suitable for quality eggs

They make a neater package, and there is no danger of the eggs absorbing objectionable odors, as there often is when packing materials are used a second time.

Mixed Packs

It may be necessary at times to put up packs of eggs of mixed color or size. The average egg buyer will have no objection to such packs if they are properly sorted and labeled. For example, a producer may have 12 dozen brown eggs and 18 dozen whites, or 12 dozen mediums and 18 dozen large; in both instances it will pay to pack them accordingly and so label the case.

Nothing irks the buyer quite so much as a case of eggs in which the large and small eggs or eggs of different colors are mixed all thru the pack.

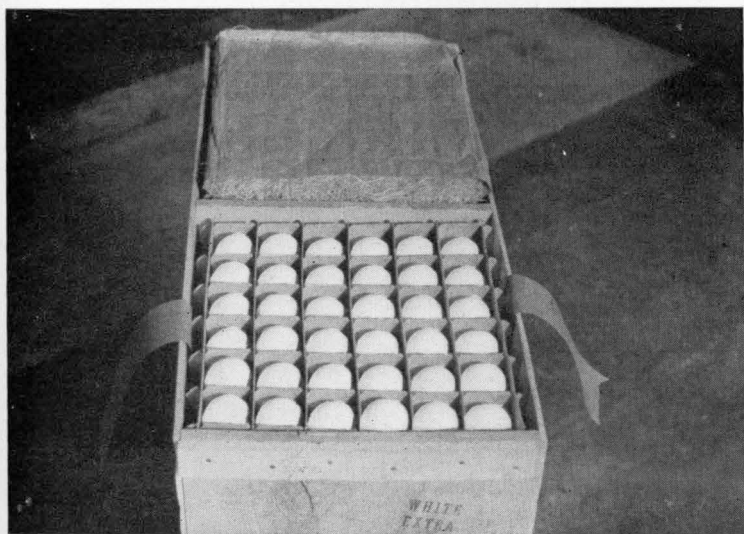


Fig. 17.—An excellent pack of 30 dozen white eggs

The eggs are uniform in size and color, and the small ends have been placed down. The packing materials—case, fillers, and pads—are fresh and clean. High-quality eggs must be well packed to attract premium prices.

PRESERVING MARKET QUALITY

Eggs of poor quality on the retail market are not always due to faulty production practices. A good part of the trouble may lie in careless handling of the eggs while they are being merchandised. Producers

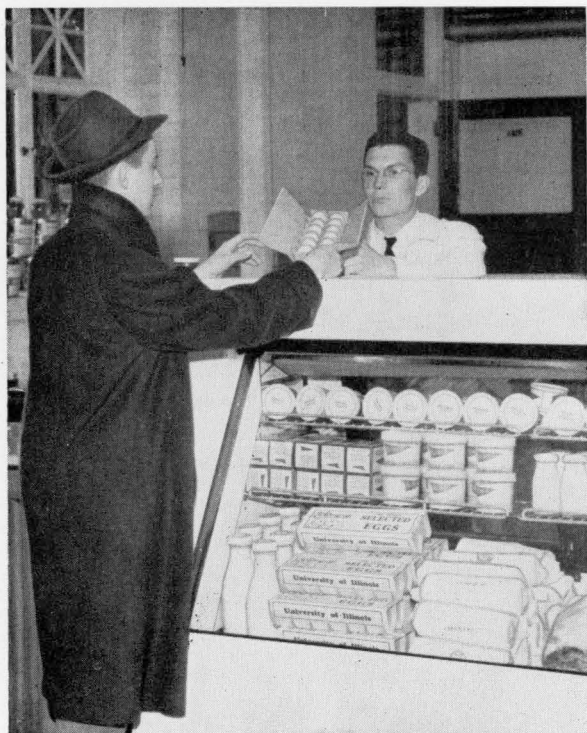


Fig. 18.—The way eggs are handled on the market counts heavily with consumers

Producers, therefore, have a vital interest in the steps the retailer takes to preserve quality. Note in the illustration that the eggs are being kept in a refrigerator.

who want the high-quality eggs they bring to market to be high-quality eggs when consumers buy them should patronize markets that are properly equipped to care for a perishable product such as eggs. When they sell to buyers who do not have such equipment, they are really "short selling" their own industry.

THE PROCESS OF EGG FORMATION

The ability of a hen to lay a large number of eggs on consecutive days¹ is determined by the time required for the egg to complete its development in the oviduct. For the average hen this time is between 27 and 28 hours, and for the poorer hens, 30 hours. In order for a hen to lay on ten or more consecutive days it is necessary for the egg to be completed in 24 to 25 hours.

When eggs are laid on consecutive days, the yolk of one egg is discharged from the ovary about 30 minutes after the laying of the previous egg. This holds true for hens of small clutch size as well as for intense layers.

Soon after the yolk has been discharged from the ovary it is swallowed by the funnel of the oviduct, where it remains slightly more than a quarter of an hour. Apparently this division of the egg duct, the funnel, contributes nothing in the way of egg formation, altho fertilization, if any, takes place here.

The naked yolk is propelled into the albumen-secreting region (magnum) by a relaxation of the muscle fibers back of the egg and a contraction of the fibers in front of it. In addition to these peristaltic waves there are thousands of tiny finger-like projections which line the entire length of the oviduct and assist in moving the forming egg toward the vent. In the magnum a dense, gelatinous layer of egg white is deposited around the yolk. About three hours are required to secrete this dense white, which constitutes about half the total white in the fully formed egg. At this stage of egg formation the white is much more viscous than the thick white of a laid egg. No thin white is present.

On leaving the magnum the yolk, with its envelop of thick white, enters the isthmus, or constricted portion of the oviduct. During the one and one-fourth hours that the egg is in this region, the cells of the oviduct secrete a keratin-like substance which forms the two shell membranes. Since the egg now contains only half of its total white, these membranes fit rather loosely. Still there is no indication of the thin white or the chalaza.

When the forming egg enters the uterus, or shell gland, water (with possibly certain minerals in solution) passes thru the shell membranes into the egg, diluting a part of the dense white and giving rise to the outer thin layer of white present in the fully formed egg. At almost the same time, the inner thin layer of white is formed when

¹The number of eggs laid on consecutive days is spoken of as clutch size.

part of the dense white next to the yolk is liquified in a process thought to be the result of enzymatic action. If this process were continued long enough, the white of the laid egg would all be thin. Fortunately this very same fraction of dense white which becomes thin contains an antienzyme which, when the action has gone far enough, comes into play and prevents further disintegration.

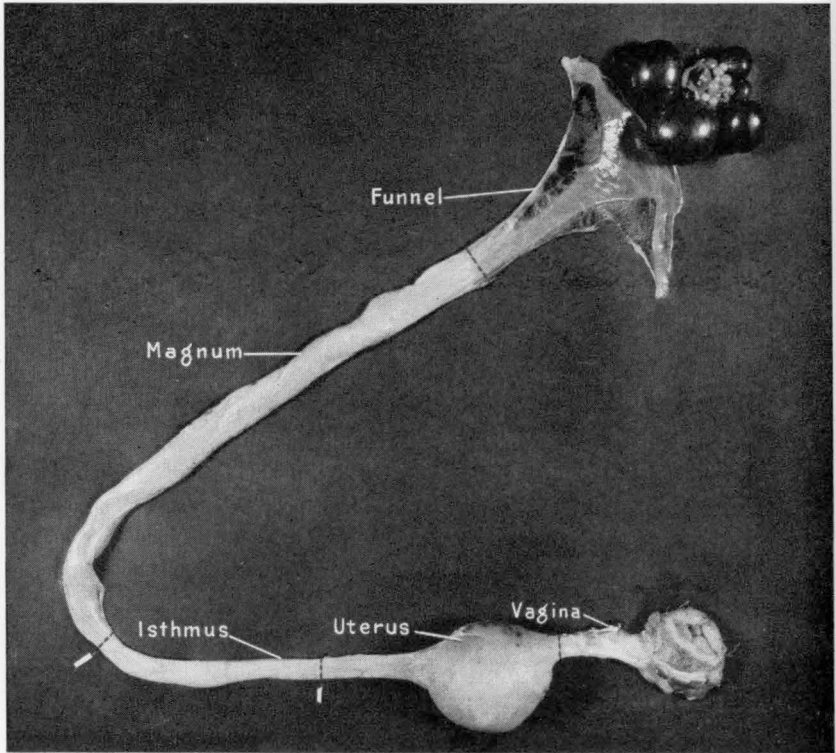


Fig. 19.—Rate of laying is influenced by time required for egg formation

From 24 to 30 hours is required for the formation of an egg. The average hen requires 27 to 28 hours. The oviduct lies almost straight in the hen's body (this one has been curved to photograph more conveniently) and has five parts thru which the forming egg passes: (1) *funnel*, which engulfs the yolk and is the point where fertilization occurs; (2) *magnum*, where jelly-like white is secreted; (3) *isthmus*, in which the shell membranes are formed; (4) *uterus* (showing egg inclosed), in which the thin white is formed, then the egg shell, and finally the color; and (5) *vagina*, from which the egg moves thru the cloaca and is expelled.

From the time the yolk is engulfed by the funnel until it enters the uterus, a period of about four and one-half hours has elapsed. After five and one-half hours in the uterus (10 hours in oviduct) the egg has acquired its full quota of white. The membranes are fully distended, shell deposition starts, and within as short a period as three to four hours the hen mobilizes enough calcium, principally from her bones, to form a rigid shell.

Up to this stage, the time factor (14 hours) is the same for low-rate as for high-rate hens. It has been previously stated that the time required for egg formation may vary from 24 to 30 hours. With the possible exception of the chalazae and part of the shell, the egg is fully formed after 14 hours in the oviduct, but it remains there for 10 to 16 additional hours, depending on whether the hen is a high-rate or a low-rate layer. No doubt the chalazae are twisted into spiral form during this last 10 to 16 hours by the rotation of the entire egg.

The reason for the difference in the time the egg remains in the oviduct is yet to be determined, but that such difference exists has been clearly demonstrated, and it explains why some hens do not lay an egg every day.

SUGGESTIONS FOR PRODUCING AND MARKETING QUALITY EGGS

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1. Produce infertile eggs.
 2. Feed a balanced ration and limit the feeding to that ration.
 3. Prevent dirty eggs by providing a nest to every 5 hens, by keeping the flock confined to the house until noon on days when it is wet outdoors, by keeping all broody hens off the nests, and by keeping the house and nests clean.
 4. Gather eggs at least twice a day.
 5. Keep eggs in a cool, moderately humid place.
 6. Always cool eggs before placing in case.
 7. Sort eggs according to size, shape, and shell color.
 8. Market eggs twice a week.
 9. Protect eggs from heat and sun when marketing them.
 10. Sell to dealers properly equipped to handle eggs.
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Prices for eggs are being determined more and more by grade. Producers, therefore, will find it to their advantage to adopt production and marketing practices that will enable them to place on the market eggs of unquestionably high quality.